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The Cornell Countryman

CORNELL UNIVERSITY
COLLEGE OF AGRICULTURE
ITHACA, N. Y.

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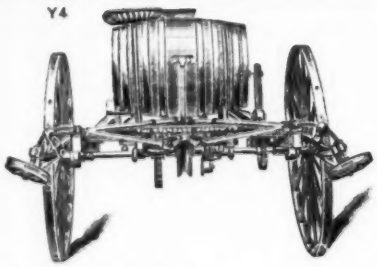

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Photo by the Author

Comparative test of steamed bone meal and raw rock phosphate, alone and with clover turned under. Pot 102 has clover turned under without phosphorus, and pots 101 and 125 are check pots without soil treatment.

THE CORNELL COUNTRYMAN

VOL. 3. DECEMBER, 1905 NO. 3

MAINTAINING SOIL FERTILITY

By Cyril G. Hopkins.

ONE of the problems which probably is, and which surely ought to be, uppermost in our minds is how to restore the fertility of our poorer soils and how to profitably and permanently maintain all our lands in a state of high productive capacity.

It should be the aim of the practical scientific farmer to help to bring about a system of agriculture which shall at least permanently maintain the high crop yields of our best soils and which shall increase the fertility of our poorer soils to their maximum profitable productive capacity.

But to grow large crops requires large quantities of valuable elements of plant food, and this brings us to the subject of "Circulation of Plant Food." This is the most important process connected with any possible system of permanent agriculture. The farmer of greatest temporary success is as a rule the farmer who takes the largest amounts of plant food from the soil; but the system of farming of greatest permanent success must be a system which will not only take large amounts of plant food from the soil, but which brings about such a circulation of plant food that so far as necessary equivalent amounts are returned, again to be used by growing crops, and again to be returned.

HISTORIC SYSTEMS OF LAND RUIN.

The almost universal practice of the civilized world up to date has been to ruin land and then cry, "Westward Ho" and he who undertakes to say that the rich soils of the great central states can never be reduced in fertility knows not whereof he speaks.

What has been the system? And what is the common practice today? First, beginning with virgin soils, we crop continuously with corn and small grains till the practice becomes unprofitable. Second, when these crop yields become much reduced, we introduce clover into the rotation and thus maintain, to some extent at least, the nitrogen. But the fixation of nitrogen is not the only function of clover, nor indeed its most effective function on many soils. Clover is a gross feeder on phosphorus. Considerable quantities of the elements taken from the soil and subsoil by the deep rooted biennial clover plant remain in the roots and stubble and, as these residues decompose, the products of fermentation and decay liberate still other quantities of phosphorus from the soil itself, thus furnishing a good supply of available phosphorus to succeeding crops of corn or other grain. (Potassium may be effected in a similar way). On soils where this is the principal effect of growing clover in rotation, applications of phosphorus produced about the same increase in crop yields as are produced by the use of clover; whereas, applications of nitrogen itself, even in the best forms, produce little or no increase in the crop. Furthermore, on such soils, about the same effects are produced by the use of non-leguminous green manures, such as rye, buckwheat, or rape, as are produced by clover or applications of phosphorus.

Usually this process continues until the clover system fails, until the clover crop is unable to obtain sufficient phosphorus for its own growth.

Landplaster and caustic lime are next brought into use to force the soil to give up plant food which could not otherwise be obtained by crops. This system is effective but short-lived, for after a score of years the soil commonly refuses to yield up the required

quantities of its remaining stock of fertility even under the destructive action of these powerful stimulants. It is this use of lime that is referred to by the well known German proverb which says: "Lime may make the fathers rich, but it makes the children poor."

Then comes the common commercial fertilizer system, in which we apply to the soil not sufficient plant food to grow good crops and maintain the productive capacity of the soil, but only enough to supplement that which can still be forced from the land. The most common application is 200 pounds per acre of so-called 2-8-2 goods applied once or twice in a four-year or five-year rotation. This means 2 per cent. of ammonia, 8 per cent. of so-called phosphoric acid, and 2 per cent. of potash. A 200-pound application of such a "complete" commercial fertilizer would supply four pounds of ammonia, 16 pounds of so-called phosphoric acid, and four pounds of potash; or, in the language of Illinois, about 3½ pounds of actual nitrogen, 7 pounds of actual phosphorus, and 3½ pounds of actual potassium, whereas a 100-bushel crop of corn would remove from the soil in one season about 148 pounds of nitrogen, 23 pounds of phosphorus, and 71 pounds of potassium; or 40 times as much nitrogen, 3 times as much phosphorus and 20 times as much potassium as is commonly applied for two or three years' crops. Sometimes acid phosphate alone is used and this is certainly less absurd than to continue to buy potassium when it is not needed, and to pay 15 cents a pound for nitrogen when it can be obtained from the air at a cost not to exceed one cent a pound, or at no cost whatever if the legume crops and catch crops are properly fed and pastured.

But even where acid phosphate alone is used the applications are usually too small to supply the needs of maximum crops and maintain the supply of phosphorus in the soil. The common practice is to remove all that can be extracted from the soil even by the aid of the 60 per cent. of manufactured landplaster, contained in the acid phosphate, and then depend upon the added phosphorus to make up the balance required by the crop. Even in the rotation experiments at the Ohio Station, where a system better than commonly followed has been practiced, the total phosphorus applied in acid phosphate during a five-year rotation is less than is contained in a single 100-bushel crop of corn.

Most farmers use more or less farm manure, and this is well, for it helps to maintain the supply of nitrogen and potassium even though it does not return much phosphorus to the land. It should be remembered that about three-fourths of the potassium in a crop of corn, wheat, or oats is contained in the stalks or straw, while only one-fourth is contained in the grain: also that when the crop is fed to animals, practically all of the potassium is returned in the solid and liquid manure: whereas about three-fourths of the phosphorus in the crop is contained in the grain, and even if the grain is all fed, a considerable part of the phosphorus remains in the bones of the animals and is thus sold from the farm.

FORMS OF PHOSPHORUS.

I firmly believe that the supply of phosphorus in the soil can be profitably maintained by the use of sufficiently large quantities of acid phosphate; and if the continued use of acid phosphate finally produces such acid conditions in the soil as to prevent the growth of clover as appears to have been a common occurrence where it has long been used, then the acidity can be corrected from time to time by applications of some form of lime.

At present prices we can profitably substitute for acid phosphate steamed bone meal, which is known to be a satisfactory form of phosphorus, and thus avoid the possible injurious effect of acid phosphate, but this suggestion could not be adopted by any large proportion of the farmers of the country because of the limited supply of bone meal.

Comparative Effect of Steamed Bone Meal and Raw Rock Phosphate, in Connection with Clover and Manure.

SOIL POT No.	TREATMENT APPLIED	WHEAT YIELDS		INCREASE Bu. per Acre
		GRAMS Per Pot	BUSHELS* Per Acre	
101	None	10.0	27	
102	Clover	16.3	43	16
103	Bone meal	14.7	39	12
104	Rock posphate	14.2	38	11
105	Clover, bone meal	22.2	59	32
106	Clover, rock phosphate	23.3	62	35
107	Manure	16.5	44	17
108	Clover, manure	22.7	60	33
109	Manure, bone meal	19.4	52	25
110	Manure, rock phosphate	19.5	52	25
111	Clover, manure, bone meal	23.1	62	35
112	Clover, manure, rock phosphate	23.3	62	35
113	Potassium	11.3	30	3
114	Clover, potassium	18.4	49	22
115	Potassium, bone meal	18.4	49	22
116	Potassium, rock phosphate	18.2	49	22
117	Clover, potassium, bone meal	21.9	58	31
118	Clover, potassium, rock phosphate	21.9	58	31
119	Manure, potassium	18.1	48	21
120	Clover, manure, potassium	19.1	51	24
121	Manure, potassium, bone meal	19.3	51	24
122	Manure, potassium, rock phosphate	19.0	51	24
123	Clover, manure, potassium, bone meal	25.3	67	40
124	Clover, manure, potassium, rock phosphate	25.3	67	40
125	None	10.6	28	

The table shows the soil treatment, the actual yields of wheat in grams per pot, the rate of yield in bushels per acre, and the gains from the treatment.

The only very extensive supply of phosphorus is the natural rock phosphate, from which acid phosphate is made by mixing a ton of rock phosphate, with about a ton of sulfuric acid, the resulting acid phosphate being sold for about $15 a ton, or $30 for the two tons of material which contain no more phosphorus than the original one ton of raw rock phosphate, which we get for about $8 delivered in Illinois.

As to the value of non-acidulated finely ground natural rock phosphate, I consider this as a material which gives great promise of extensive use in the economic and profitable improvement of poor soils and in the maintenance of large crop yields on good soils. It should be distinctly understood, however, that repeated experiments have shown that small applications of this material give practically no immediate returns if used in the absence of decaying organic matter. On the other hand, when used in intimate connection with liberal amounts of farm manure or green manure or both, we have conclusive evidence that it is one of the most economic and profitable forms of phosphorus, especially where

*The pots used in these investigations are 10½ inches in diameter, consequently 1 gram per pot corresponds to 1 pound per square rod or to 160 pounds per acre. The actual yields in grams per pot are given but the results are also computed to bushels per acre.

the crop returns for a series of years are to be taken into account.

The fact that steamed bone meal costs $25 to $30 a ton, while raw rock phosphate, equally rich in phosphorus, can be bought for one-third as much, has led several experiment stations to investigate the practicability of using raw rock phosphate. Some good results have been obtained by the experiment stations of Ohio, Maryland, and Illinois.

POT CULTURE EXPERIMENTS.

A series of pot culture experiments recently harvested at the Illinois Station furnishes some additional data on the relative values of steamed bone meal and raw rock phosphate. The soil used was the gray silt loam of the Lower Illinois Glaciation, and wheat was the crop grown in the pots. The phosphate used is known as the "blue rock phosphate," which is thought to be somewhat more readily available than the "brown rock phosphate." In certain pots the phosphorus was turned under with a good growth of clover; in other pots with farm manure, and in others with both clover and manure. In all cases equal money values of bone meal and rock phosphate were applied, that is, the quantity of rock phosphate applied was three times the application of bone meal.

It will be seen that the untreated soil (pot 101) yielded at the rate of 27 bushels of wheat per acre (28 bushels on the duplicate pot No. 125). Where clover was turned under (102) the yield was increased by 16 bushels; that is, from 27 to 43; and where bone meal was turned under with clover (105) the rate of yield was 59 bushels per acre, the increase of 32 bushels being just double that produced by clover without bone meal.

Where raw rock phosphate was turned under with clover (106) the wheat yielded at the rate of 62 bushels per acre, making a total increase of 35 bushels over the yield of the untreated soil. Of this 35-bushel increase, 16 bushels should be credited to the clover and 19 bushels to the rock phosphate.

It will be observed that rock phosphate used alone produced an increase of only 11 bushels, which added to the increase of 16 bushels due to clover alone makes only 27 bushels. In other words the sum of the gains which they make when used separately was 8 bushels less than the increase produced when the rock phosphate and clover were turned under together. Somewhat similar results are produced with clover and bone meal when used separately and together; also with bone meal and potassium, and with rock phosphate and potassium, one of the chief functions of the potassium apparently being to increase the availability of the phosphorus in the bone meal and in the rock phosphate. Such extraordinary combined action does not appear, however, from other combinations.

As a general average the rock phosphate has made slightly better gains than the steamed bone meal.

VALUE OF POT CULTURES.

It is appropriate to emphasize the fact that those who study very thoroughly carefully conducted pot culture experiments are those who have the most respect for the results which pot cultures furnish. The information obtained in pot culture work is usually reliable and correct, although two or three years' field experiments are commonly required before the pot culture results are fully confirmed, largely due to the fact that field plots are rarely if ever exactly uniform and comparable, and to the fact that unfavorable weather conditions, uncontrolled by human agency, often modify the field results.

QUALITY IN POTATOES

By John W. Gilmore.

RECOGNIZING that the food value of potatoes is almost entirely dependent upon their starch content, extensive analyses have been made to determine the amount of starch in the potato and its proportion to other substances and water. The starch, protein and fat content, and the presence of other substances which influence flavor and color have been considered the factors upon which quality is usually based. The standard of chemical composition is fairly adequate when only the utility of potatoes for the manufacture of starch is considered, and perhaps also when potatoes are used only for stock food, but the amount of potatoes used for these purposes in this country is small. In France and some other parts of Europe potatoes are grown directly for starch manufacture and for stock feeding purposes as well as for table consumption.

It is true, however, that the starch content must be considered in any estimate of the quality of potatoes; for, when this is deficient or falls below a certain standard (about 17 per cent.) the indications are that the tubers have not developed properly, have not ripened, or they have grown under adverse climatic or soil conditions; and such potatoes prepared for food will not meet the standard set for table potatoes in this country. The culinary value of potatoes varies with the tastes and estimation of different peoples. In the United States a tuber of a starchy flavor, white or floury in color and mealy when cooked, is considered of better quality than one which is strong, colored or soggy after boiling; this mealy condition is usually found in potatoes with a starch content ranging from 17 to 20 per cent. though such conditions may not depend directly upon starch content. In France, on the other hand, potatoes which retain their form, are yellowish in color, and are soggy after boiling are most desired for culinary purposes. This condition is usually found in potatoes low in starch content and high in protein. Coudon and Bussard, two French investigators, conclude from their extensive studies upon this subject that the culinary value of the potato is directly proportional to its total nitrogen content, and inversely proportional to its richness in starch.*

There are trade estimates of quality in potatoes which have no direct relation to the culinary or structural considerations. These may be classed as size, surface aspects, shapeliness, and variety considerations.

Usually the trade does not call for potatoes of excessive size. Those ranging from two to three inches in length and weighing from 5 to 10 ounces are most acceptable. If larger or smaller than this, for whole or baked potatoes, they are non-uniform in cooking qualities and do not look well when put upon the table. Then, too, in preparation for cooking, the large tubers have to be cut in order that they may be uniformly cooked before the small ones are over done. There is slightly more waste also in paring. The surface aspects and general shapeliness of the tubers are perhaps the greatest considerations of the discriminating consumers. So far as we are able to determine, the pink-skinned varieties are in general quite as good in quality from a culinary point of view as those of light or yellowish color. The blue and dark tubers are not desirable for table use except for salads and garnishings. Excepting the potatoes put on the market as earlies, those having a more or less netted skin, or those whose skin has a corky appearance or touch, are usually preferred to the smooth and clear-skinned tubers. This appearance or touch, is, in some instances, a variety characteristic, but in general it indicates a

*Annales de la Science Agronomique, 2nd ser. 1897, p. 276.

degree of maturity or development which promises good cooking quality. On the other hand, the potatoes of smooth and clear skins are oftentimes excessively watery or immature. Potatoes with numerous and deep eyes are also objectionable because they may carry much dirt, and the labor, time and waste in preparing them for cooking are much greater than is the case with potatoes of even surface. Tubers having deep notches and quick curves in their surfaces are also usually avoided, while those of oval, flat-round and elongated-oval shape are most desirable.

Cross-section of tuber showing the zones. The envelope or skin may be recognized.

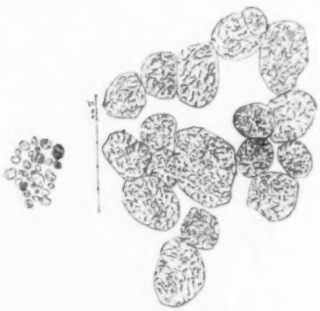
Quality in potatoes, from both the culinary and trade points of view, varies to a limited extent in different varieties; but as a general rule, a knowledge of variety characteristics is possessed only by those who have given the question some study. However, it is a matter of common observation that some varieties resist rot in storage better than others and some deteriorate in cooking quality after going into storage. Undesirable flavors or colors are developed and sometimes the tendency to break down into a mealy condition upon boiling diminishes.

If "the proof of the pudding is in the eating" then it is desirable to find out if possible what characteristics a potato possesses which render it acceptable upon the table. From studies and investigations extending over two years, it seems that the culinary and dietetic quality of potatoes is not dependent upon chemical composition so much as it is upon the anatomical (and perhaps physiological) characteristics of the tuber, and the arrangement and distribution of starch and water areas in its substance, and also that the structural characteristic of the tubers is influenced by the conditions of the soil, and of the soil and atmospheric climate in which the potatoes grow.

In order to arrive at some basis for estimating the quality of potatoes from studying its structure and to train the judgment it will be necessary to study the parts of a potato. If a cross section of a tuber is made and a slice about 2 mm. in thickness from this section is held up to the light, or even carefully examined by reflected light, four zones or areas will be recognized. Using the nomenclature followed by Coudon and Bussard, these are:

1. The Envelope or Skin comprising the corky covering of the tuber.

2. The Cortical Layer which is just within the envelope and varies from one-eighth to one-half inch in thickness. This part is generally more dense than any other and is separated from the interior by a well marked ring containing fibro-vascular bundles.



Showing the relative size of cooked starch grains at the right and uncooked at the left.

3. Within the cortical layer is the External Medullary area which comprises the main starchy part of the tuber. This part varies considerably in uniformity. If it is non-uniform to a marked degree the tuber is likely to be of poor quality.

4. The Internal Medullary area occupies the central part of the tuber and

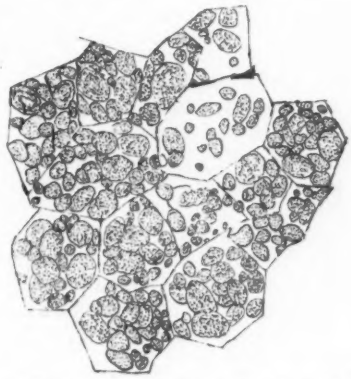
often having branches permeating the external medullary area. This area is usually more or less translucent, inasmuch as it contains much water and but little starch. When this area is large and branching the tuber is likely to remain soggy when boiled or it will have resistent lumps which will not mash readily.

In cooking, mealiness is the most important consideration in estimating quality. In general this character follows upon the presence of sufficient starch in the cell to rupture its walls when cooked. The grains of potato starch expand and coalesce when boiled in water, and if the cells are sufficiently full of these bodies this expansion will cause the cellular structure to be broken down and a degree of mealiness is the result. When the requisite amount of starch is not present in the cells, its walls are not broken down in cooking, hence the tuber retains its form, or is soggy. When the internal medullary area is large and branching (in the variety Doe's Pride) the

From the internal medullary area showing the paucity of starch in the cells of this part.

external medullary area is not uniform, and when the tuber is boiled in water it is hard and soggy or it contains portions which will not mash uniformly and readily. Both by analysis and microscopical examination the internal medullary area is observed to have less starch by as much as five or six per cent. than the external medullary area.

If, as stated, the starch grains expand when boiled in water, it would seem that a cooked tuber ought to be greater in volume than a raw one, but this is not the case to any marked ex-



From the external medullary area showing the abundance of starch in the cells of this part.

tent. The boiled tuber contains about the same percentage of water as the raw one. Three trials out of four showed a loss in weight by boiling of from three to ten grams, while one trial showed a gain of a little over three grams.

These observations seem to point to the conclusion that although the starch grains expand greatly on boiling; yet the volume of potato substance is not materially increased because in expanding, the starch grains incorporate the water which was originally in the tuber in a free state. In other words, the mass acts somewhat as a sponge. If the cortical layer is thin, the skin netted, and the external medullary area uniform, the texture crisp and the internal medullary area small, the tuber generally becomes mealy when boiled.

It is pertinent to mention here the practical bearing of these studies of quality upon the production of potatoes. Results of the investigations indicate that while the largest numbers of tubers are produced in the upper two inches of the soil, yet the greatest weight of tubers and tubers of best quality are produced under from three to five inches of soil. We believe that

the superior yield and quality of potatoes growing from two to five inches in depth is due to the prevalence of more uniform temperature conditions during each twenty-four hour cycle, and also to the constancy of the moisture in this depth of soil. Throughout the growing season the temperature in the soil varied only about three-tenths of one degree between the two, four and six inch depths, while the temperature at two inches dipped two degrees lower and rose two and one-half degrees higher than the temperature at four and six inches in depth during the twenty-four hours. The temperature at four and six inches depth was more nearly constant. The average moisture content during the growing season in the upper two inches of soil was 13.26 per cent, varying from 8.75 per cent. to 16.98 per cent. while that at four and six inches was 15.12 per cent, and 15.91 per cent. respectively with narrower variations.

Another factor in the growth and development of potatoes which influences quality is the degree of maturity. A distinction, however, must be made between those potatoes taken from green plants in the midst of their vegetative growth and those taken from plants which have died because of the close of the season. Though immature, the former are esteemed of good quality, while the latter are of uniformly poor quality. We believe that the cessation or retarding of growth of the tubers, as the plant dies slowly, causes abnormal development in both composition and cellular structure, while tubers taken from the growing plants are suddenly interrupted in the midst of normal growth and development. Immature potatoes are relatively richer in protein and poorer in starch than normally developed and ripened tubers, and they are also more watery.

Fortunately the factors which seem to influence quality in potatoes are within control of the thoughtful potato grower. Given a good variety and a good potato soil it is believed that good quality is developed under a uniform soil temperature of 65 to 75 degrees; and that great fluctuation in soil temperature is detrimental to the best development of potatoes. These facts bear directly upon the depth at which potatoes should be planted, best results being obtained when planted at a depth of from four to six inches.

The consideration of quality in potatoes has a close relation to the problems of improvement and breeding, and it is to be hoped that in future work along this line quality may be considered as important a factor as yield.

THE FARMER'S STORE

Heap high the farmer's wintry hoard!
Heap high the golden Corn!
No richer gift has Autumn poured
From out her lavish horn!

Whittier.

INDIVIDUALITY OF THE WHEAT KERNEL

By Harry Snyder.

WHEAT kernels show a greater individuality in chemical composition and physiological properties than is generally conceded. In nearly every sample two distinct types of kernels are present, even in wheats that have descended from a single kernel or mother plant. In the study of individual wheat kernels at the Minnesota Experiment Station, reported in Bulletins Nos. 85 and 90, it was found that from the same sample of wheat starchy and glutinous kernels with as much as 5 per cent. difference in protein content occur, while kernels grown from a uniform lot of seed showed a range in protein content of from 13.81 to 17.51 per cent. Even individual seeds from the same head showed a difference of 1.62 per cent. This suggests that in all varieties of wheat there are two types, glutinous and starchy. In some cases these differences are so slight as to scarcely affect the physical properties or the general appearance of the grain, while in others they are so pronounced that the two types of kernels can readily be distinguished even by the untrained eye.

Why there should be so large a difference as 4 per cent. or more in the protein content of wheat grown from an apparently uniform lot of seed is not difficult to understand when it is remembered that wheat is self-fertilizing, and whatever starchy or glutinous tendencies an individual kernel may possess makes itself manifest upon reproduction. That the tendency to reproduce either starchy or glutinous kernels exerts itself is shown in the analyses of a large number of samples of both commercial and pedigreed wheats.

The glutinous wheat kernels are characterized by a darker amber color and by a harder and more flinty texture than the starchy kernels. When the two types of kernels are cut through horizontally, the dark color and the hard and horny character of the glutinous wheats and the lighter color and more floury nature of the softer starchy wheats are readily observed. Occasionally a kernel of wheat is found, one-half of which is starchy and one-half glutinous.

In the analyses of separate wheat heads, slight differences in the nitrogen content of individual kernels have also been observed, and in many cases it was possible to distinguish starchy and glutinous seeds on the same wheat head. When grown from the same glutinous seed individual kernels varying in degree of gluten are produced. In the case of four samples of wheat grown from a uniform lot of seed containing 14.57 per cent. of protein, a range in protein content of from 13.81 to 18.45 was secured. In the case of individual kernels produced upon the same wheat head, the difference in protein content was small, but still there was an appreciable difference, showing that each head and each kernel, as far as chemical composition is concerned, has an individuality.

Some misconception seems to exist as to the relative importance of protein or gluten is assigning a value to wheat. It is generally held that the larger the amount of gluten, the more valuable the wheat for flour and bread-making purposes. This is true for wheats with protein content of less than 15 per cent. but an excess of gluten over 15 per cent. does not add to the bread-making qualities of the flour. Experiments made at the Minnesota Experiment Station show that the breads produced from wheats of high protein content are not of better quality than those of average protein content and that whenever additional gluten, even to the extent of 15 to 20 per cent, was added to the bread, the size and physical qualities of the loaf were not improved. In regard to the nutritive value, a high protein content is desirable, provided it is associated with other characteristics, such as improved bread-making value. However.

in the case of wheats containing 15 per cent. of protein, the ratio of proteids to carbohydrates is about 1 to 5, and any increase in the amount of protein would unnecessarily increase the amount of nitrogenous matter in a mixed ration. Hence it is that it is not necessary to aim to develop wheats of abnormally high gluten content. To do this, it would undoubtedly be necessary to sacrifice yield, as abnormally high nitrogen content and large yield are antagonistic characteristics. The high yielding, medium gluten content wheats are undoubtedly the ones that will prove the most valuable to the farmer, the miller and the consumer. It is certainly a safe type of wheat to adopt as a standard, rather than one having either an abnormally high or low protein content.

A great many of our wheats contain too small an amount of gluten, and in the selection of seed due regard must be given to maintaining its glutinous character. But this should be combined with other desirable characteristics, as a high yield per acre and a high flour yield from the grain. An even gluten content is important in the selection of seed wheat. It is not possible to compare samples of wheat grown in different localities and under different conditions and assign a relative gluten value on the physical appearance of the wheat alone, as a less amber and horny kerney of one sample may contain more gluten than a darker colored and more corneous kernel of another sample. It is only when the starchy and glutinous types are selected from the came sample that these comparisons will be found to hold true. Nature herself has carried on this process of selection and has produced seeds of both high and low protein content, which can be readily picked out from physical appearance alone.

A study of individual kernels has also shown that the highest nitrogen content is present at earlier stages of growth, rather than at the time of maturity. Thus it is that if the selection of seed were made on the basis of nitrogen alone, immature and light weight seeds would be selected as the ones containing the maximum amount of gluten. The study of heavy and light weight grains showed that, while there is a larger percentage of nitrogen, phosphoric acid and potash in light weight seeds than in mature, well developed, heavy weight seeds. 100 heavy weight kernels will contain from two to four times as much nitrogen, phosphoric acid and potash because of their greater weight than the same number of light weight seeds. Thus, while the light weight, immature seeds have somewhat the advantage in percentage composition, the heavy weight matured seeds have decidedly the advantage because of their greater weight and larger content of the most valuable plant food nutrients. When the heavy weight seeds are selected for seed purposes, the additional reserve plant food at the disposal of the growing crop is often sufficient to materially affect the vigor of growth and the yield of grain.

Seed selection and the breeding of high grade grains alone will not solve the problem of better grain production, unless due consideration be given to the cultivation of the soil and the conservation of its fertility. Seed and soil stand in the same relationship in crop production as breeding and feeding in live stock production. Neither can produce the best results alone.

Wheat raising during the past third of a century has been confined largely to the new lands in the western states, but with no large areas of new lands to be brought under cultivation and a reduction in the yields per acre on old lands due to excessive and exclusive wheat production, more wheat will undoubtedly be produced on eastern farms. This will require more systematic farming than has been practiced heretofore, and more attention must be given to seed and soil. By careful selection of the seed, a better quality of grain can be secured, and by proper treatment of the soil, particularly in the way of increasing its fertility, the glutinous character of the wheat can be largely maintained.

SCENE DURING HOP HARVEST

HOP CULTURES IN NEW YORK STATE

By C. H. Curtis.

THE hop crop is more fluctuating in selling value than almost any other, ranging in extreme market conditions from one cent to one dollar per pound. The latter price and even $1.25 was reached in 1882.

To the grower, there is a large element of uncertainty from early spring till the crop is harvested, sold and the proceeds deposited in the bank. A speculative condition prevails from beginning to end, so that the grower, if he is a careful, cautious, conservative man, may well hesitate about becoming almost a gambler.

In consumption it has practically but one use—in yeast for brewers, distillers and bakers. Unlike many other products it does not find any material increase of consumption when crops are large and prices low. Its use is limited.

While its cultivation is confined to limited localities, it is still grown in several countries. In the United States it is mainly on the Pacific Coast and New York state, and sections of Wisconsin and Maine. Outside of this, it is an important crop in England in parts of Europe, with a few in distant Tasmania. The more important localities are the Pacific Coast and Europe, New York state and England having less acreage than formerly. England has now less than two-thirds the acreage of 20 years ago.

New varieties may be formed by hybridizing and selections from seedlings, but so far as I know, this has not been systematically attempted, and new kinds have been found by accident. There is opportunity for some one, with Luther Burbank's skill, to take hold, for new varieties are needed and this field promises as splendid results as have been realized with new kinds of potatoes.

At one time the writer had 500 or 600 seedlings but none of them promised anything better than those now cultivated. The skill and experience of a trained experiment station worker is needed to develop new varieties,

[Continued on Page 76]

The Cornell Countryman

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DECEMBER, 1905

Status of Agricultural Students.

WE FEEL grateful to Director Bailey for the worthy manner in which he upheld the dignity of the Agricultural College. In answer to the questions asked him by the editor of the *Era* he says that, if in any way the students in Agriculture have been disregarded by the other University students, it is not in the least annoying to him nor has it embarrassed the College of Agriculture.

We grant that such prejudice may have existed in the past but that it exists now is very doubtful. Last year the College of Agriculture was recognized by the student body as the most united college in the University and one of high social standing. Students at large admired this spirit and often remarked that the students in Agriculture enjoyed more good social times than those of any other college.

Several instances occurred last year where sons of parents, wealthy and of high social standing, asked before entering the Agricultural College if it would in any way lower that social standing. The answer in every case was "No" with the explanatory clause that the social standing of the students in agriculture was equal to that of the students in any other college. Prejudice which may have existed has to all appearances now passed away and the very fact that the question is being discussed is evidence that its existence is doubted.

The Agricultural Student and The Grange.

IT IS TRUE that the great majority of the students in the College of Agriculture expect to enter some line of agricultural work. Many of us will return to the farm; many will go out as teachers; some will devote our lives to investigation. Although our paths will, of necessity, be separate, our purpose will be the same—the elevation of the farmer. As teachers, investigators, farmers, this problem confronts us; How shall we keep closely in touch with each other, where shall we meet as brother meets brother, by what co-operation shall we become most efficient, through what organization can we accomplish the most towards realizing our ideal? There is but one answer—the Grange.

The Grange is an organization of the farmer, by the farmer, and for the farmer. It was founded by farmers; none but farmers, or those interested in agriculture, are members, (and among its constituency are to be found the most prominent agricultural leaders in the country); its sole purpose is to enrich and elevate the life of the farmer. The Grange combines, to a high degree of perfection, the moral and intellectual, as well as the social and fraternal aspects of farm life. Again, it is free from the objections common to many secret societies. Indeed, the only reason for its existence as a *secret* organization is that "everybodys' business is nobody's business," and the Grange is, above all things, a place where purposes are accomplished, where things are *done*.

But for the Grange, the Rural Free Delivery, with its multitudinous benefits, would still be in the future. Pure food laws find support in its meetings, as does much other wise and beneficial legislation. It is the farmer's "open court," where he may speak, discuss, or be entertained, as he sees fit. In a word, the Grange is a concrete embodiment of the idea of the elevation of the farmer, not through some extraneous agent, but by the free working of his own mind.

For these reasons, weighty and of real significance, every student in the College of Agriculture should be, outwardly as well as inwardly, a true Patron of Husbandry.

A Winter Course for Farm Women

THE College of Agriculture at Cornell University is adding one more facility for the benefit of farm women by offering for the coming session a winter course of eleven weeks in Home Economics for the benefit of farmers' wives and daughters. This is in addition to the new short course in horticulture offered for the first time this year. The course opens January 2nd and closes March 20th. It is free of tuition to all residents of the state. The only expenses are the personal outlays for living and traveling. For the present winter this Course is to comprise a series of lectures by the leading women in the field of householding, domestic science, and economics as applied to the home. About twenty women have been engaged to give these lectures and demonstrations. Among those who will take part are the following: Mrs. Ellen H. Richards, Institute of Technology, Boston; Dean Marion Talbot of the University of Chicago; Miss Isabel Bevier of the University of Illinois; Miss Abby L. Marlatt of Providence, R. I.; Miss Alice P. Norton of the University of Chicago; Mrs. James Hughes of Toronto, Canada; Miss S. Maria Elliott, Simmons College; Miss Anna Barrows, Boston; Miss Helen Kinne, Teachers' College, New York, and others of national reputation.

As will be seen, this is to be the most distinguished gathering of its kind ever held in this country and it presents to every farmer's wife and daughter an opportunity which they will do well to embrace. If you wish further information, it will be gladly given by Miss Martha Van Rensselaer, Morrill Hall, Ithaca, N. Y.

GENERAL AGRICULTURAL NEWS

The Farmer and Breeder recently gave an account of a goat dairy located at Colorado City. It is owned and operated by Messrs. F. A. Stephens and B. H. Stahlman and has proved a financial success.

The operation of milking is a unique one. Instead of sitting down to milk, the operator drives the goat through a passage-way which leads up to an inclined platform on a level with the milker, who stands up and extracts the milk. The total daily output of this dairy is 50 gallons of milk, each goat averaging about one-half gallon.

* * *

The American Pomological Society recently held a meeting in Kansas City. At this meeting Professor John Craig was elected secretary of the organization.

* * *

Mr. Henry Ford a native of Michigan has recently invented a farm automobile. The inventor claims his machine will cost only $400 and that it

will do the work of four horses. It can also be transformed into a stationary engine for running machinery.

Mr. Ford is a practical farmer which gives us reason to believe that his new invention may prove useful and practical.

* * *

The government of Victoria has recently given a new endowment to the University of Melbourne. This endowment was given with the understanding that the University would use it to establish a course in Agriculture leading to a degree.

* * *

The following article taken from the *Breeders' Gazette* throws a good light upon the rapid advancement of agricultural colleges. It also shows in what high esteem the agriculture college is held at the present time:

"Practically without exception American agricultural colleges recently opened their fall terms with increased attendance. In some instances the enrollment has been almost doubled. Altogether the increase has been marked, indicating wonderful growth and distribution of interest in agricultural education. It is a good token. Nothing is more significant as showing the trend of the times. It requires but ordinary mental penetration to see the day when the largest success in agriculture as a business will depend upon technical training and commercial sagacity. The colleges ought to be overflowing, every one of them. Their mission is to shape the destiny of agriculture and hence of the nation through their students. Their responsibility is tremendous but they are equal to it. What they have accomplished within a few years in the face of a disappearing prejudice is a trustworthy earnest of a great service in future."

* * *

The Norton County High school of Norton, Kansas, has recently established a four-year course in agriculture. The new department already has an enrollment of nine boys out of 70.

Mr. A. F. Turner, a graduate of the Kansas Agricultural College is in charge of the course.

* * *

The Experiment Station Record for October, 1905, gives the following excellent description of the new College of Agriculture at Manitoba:

"Buildings are being erected for a new college of agriculture for Manitoba, established by a recent session of the provincial legislature which appropriated $200,000 for the purpose. The college is located at Winnipeg and its principal is W. J. Black, a graduate of the Ontario Agricultural College, who will have charge of the work in animal husbandry. The principal buildings consist of a main building 131 feet long by 67 feet wide and three stories high above a high basement.

The main building is of stone and white brick and the science and dairy building of brick with a stone foundation. The main building in addition to providing laboratories, class rooms, a library, and an auditorium with a seating capacity of upward of 500 will afford temporary accommodations for about 60 students, the intention being to erect a dormitory building when the increase in attendance warrants. The basement and first floor of the dairy and science building will be used for butter and cheese making, milk testing, home dairying, etc., and the upper floor for laboratory and class room purposes.

In addition to these two buildings a power house, principals' residence, live stock auditorium, and horse and cattle barns are being provided.

The horse and cattle barns are of modern design, and the live-stock auditorium, which connects them will afford seating capacity for about 300. The college farm consists of about 117 acres and is immediately outside the city limits of Winnipeg on the Assiniboine River. The college buildings are located on the banks of the stream, about four miles from the center of the city.

The regular college course will ex-

tend over two years, and will open immediately after the fall work on Manitoba farms has been completed and close in time to allow students to reach home before the spring work begins. There will be no rigid entrance examinations, the main requirement being a sufficient knowledge of the English language to benefit by the lectures and practical experience on a farm covering at least two summers. A tuition fee of $10.00 per annum will be charged, and board will be furnished at actual cost. There will be a special dairy course in butter and cheese making to cover from 10 to 14 weeks. 'The college in its teaching will be practical in the highest possible degree. It will train practical farmers, not educate them along lines calculated to lead young men away from the farm.'

It was expected to open the college to regular students in January, but owing to the delay in building, this has been abandoned. It is planned, however, to carry on the dairy school and to offer short courses in animal husbandry and agronomy. W. J. Carson has been elected professor of dairying."

CORNELL NEWS

CAMPUS NOTES

In accordance with the promise made last month to our readers we will furnish the following report of the progress on the new Agricultural buildings: The masonry contract for the whole group of buildings has been sublet to Mr. Dempsey, who had charge of the Masonry work on Goldwin Smith Hall, and it is expected that he will push the work as fast as possible. He reports satisfactory progress so far. The contractor proposes to have as much grading as possible done before freezing weather begins. Already considerable progress has been made along this line, especially around the Agronomy Building. The walls of the Agronomy Building are finished up to the water table, which is to be a course of Indiana limestone. These walls are to be covered with tar paper and plank, and left as they are until spring. The workmen are now laying the plates on the extension of the Dairy Building preparatory to roofing. Most of the brick-layers are working on the main part of the Dairy Building and the walls are now a few feet above the first floor level. It is the intention of the contractor to have the Dairy Building enclosed before winter sets in, so that some inside work can be done. Quite a little progress has also been made on the interior basement walls of the Main Building.

* * *

A very enjoyable Agricultural Assembly was held on the evening of November 2 in Barnes Hall. After Professor Bailey's address the Assembly was entertained by Mesdames Hunt, Gilmore, Troy and Hunn in a way that left nothing to be desired. Fruit punch and fancy cakes were served and every one enjoyed the evening thoroughly.

* * *

Messrs. Hogenson and Brown of the United States Bureau of Soils have been assigned to study some of the problems in soil management in co-operation with the Cornell Experiment Station. Mr. Braziele will also conduct studies of fertility of soils with particular reference to soil solutions. These problems will probably be carried on for several months. Students may confer with any of these men on problems connected with Soils work.

* * *

Mr. W. G. Johnson, editor of the *American Agriculturist,* and Mr. C. M. Shultz of the *Associated Farm Press* have accepted invitations to give lectures in the course on Agricultural Journalism which is to be given this winter.

The total registration in the College of Agriculture is now 219, made up of the following groups:

New regular students	55
Old regular students	67
New special students	59
Old special students	38
Total	219

There are 122 regulars and 97 specials, which is a decrease in the proportion of the latter.

* * *

Since Dr. Fletcher left us, Mr. G. W. Hosford has had charge of the Reading Course. Dr. Fletcher's work has been divided and Mr. G. D. Brill, who took his B. S. A. degree here in 1888, has been secured to take the work of the Winter Course in Agriculture. Mr. Brill has had charge of the grounds of the Lake Placid club in the Adirondacks, and has secured a leave of absence in order to take up the winter work here. He has had a long practical experience in farm management and will be a valuable addition to the staff here.

* * *

Mr. J. S. Cates, a graduate student in agriculture, has received an appointment to the Bureau of Plant Industry at Washington. He is to develop methods of weed eradication.

* * *

G. Harold Powell, Pomologist in charge of Fruit Transportation and Storage, U. S. Department of Agriculture, is investigating the relation of commercial methods of handling perishable fruit to their shipping quality and to their keeping in cold storage. The investigations have been conducted since 1901 in various parts of the country with special reference to cold storage. During the past year or two they have been extended to transportation problems. Mr. Powell is now investigating the losses that occur in shipping oranges and lemons from California. The industry there amounts to 30,000 carloads of fruit and the annual losses from decay in transit are about one-half million dollars. As a result of the experiments of the last year, which included the shipment of $30,000 worth of fruit, the fact has been established that a large proportion of the losses are the direct result of the rough handling of the fruit in the groves and packing houses, making it susceptible to decay. During the coming year not less than $75,000 to $100,000 worth of fruit will be shipped from California under different conditions in the groves, packing houses and in transit to determine the most practical methods of overcoming these losses.

Mr. Powell recently visited Cornell for a few days, and during his stay he delivered an extremely practical and interesting lecture before the class in Systematic Pomology on "The Growing, Handling and Marketing of Citrus Fruits."

* * *

The Horticultural Department has received a very important consignment of peonies from Europe. Goos and Kooneman of Germany sent 200 varieties, which arrived in excellent condition, in spite of the fact that the roots were six weeks in transit. Many of the rarer kinds were included in this lot. Four other consignments were received, making an addition of 400 varieties to the 1,600 varieties which were planted last spring. These flowers are to be used in the study of synonomy.

* * *

At a meeting of the Poultry Association on November 9th the following Board of Directors was elected for the ensuing year: Prince, Gable, Thayer, Jackson, Moody, Martin, Miss Jenkins.

* * *

Messrs. Orr and McGrew have been engaged for lectures this year. Mr. Orr will speak here January 24, 25 and 26, while Mr. McGrew will speak on February 8, 9 and 10. Poultry students are extremely fortunate in having the chance to hear these experts.

* * *

The Annual Meeting and Winter Fair of the New York State Breeders' Association will be held at Syracuse,

December 19 to 21, under the auspices of the 41st Separate Military Company. The Fair should be of especial interest to all Cornellians on account of the part which the College of Agriculture is to take. The following addresses will be given by Cornell professors:

"Experiments on the Utilization of Skim Milk for Feeding Swine," Professor H. H. Wing.

"Explanation of the Awards of Dressed Fowls," Professor J. E. Rice.

"Explanation of Judging Root Crops with a Discussion of Desirable Qualities," Mr. Samuel Fraser.

Lieut.-Governor M. Linn Bruce and Asst. Sec. of Agriculture W. M. Hays will also speak.

The Agricultural College proposes to make an extensive exhibit of roots, dressed poultry, fat lambs, and steers (Galloways, Shorthorns and Herefords.)

* * *

The College will exhibit several pigs at the International Live Stock Exposition which is to be held at Chicago, December 16 to 23.

* * *

The present registration of twenty students in the two-years' course in Nature Study shows a decided advance over the eight last year. This is an evidence of the increase of interest in this line of work. The Nature Study work includes many of the natural sciences and the method of presenting them in the school room. For laboratory practice, the students do actual teaching in the Ithaca schools, one or two rooms being assigned to each person for his special problem. The aim of the course is to bring the student into closer contact with nature on the one hand and with children on the other, and to see, to understand, and to appreciate what is going on in the outdoor world.

* * *

Prof. J. E. Rice spoke at the Farmers' Institute at Farmington, N. H., on November 9th.

FORMER STUDENTS

'98, Ph. D.—Cyril G. Hopkins was born of English-Canadian parentage on a farm near Chatfield, Minn., July 22, 1866. When he was fourteen years old his parents moved to a farm near Estelline, South Dakota. His early education was received in the country schools of Minnesota, and the village schools of Estelline. He entered the South Dakota Agricultural College as a preparatory student in 1885, and was graduated with the degree of Bachelor of Science from the agricultural course in 1890. During his college course he worked on his father's farm during the short summer vacations, and taught in the country schools during the long winter vacations then in vogue at that institution.

CYRIL G. HOPKINS, PH.D., '98

After graduation he was appointed assistant in chemistry in the S. D. Agr. College. He entered Cornell as a graduate student in 1891, and was appointed assistant in chemistry in 1892. The following year he was again appointed assistant in chemistry and also acting professor of pharmacy in the S. D. Agr. College. He continued his graduate work at Cornell

during the winter vacations, and received the degree of M. S. in 1894. In 1897, he returned for a year's study, receiving his doctor's degree in 1898.

In 1894 he was elected chief chemist of the University of Illinois Agricultural Experiment Station, which position he still occupies. In 1900 he was made chief in agronomy in the experiment station and professor of agronomy in the agricultural college; in 1903 he was elected vice-director of the Illinois Experiment Station.

Professor Hopkins is the author or joint-author of a large number of papers, circulars, and bulletins on chemical and agricultural subjects, among which are: "Chemistry of the Corn Kernel," (thesis for Ph. D.); "Methods of Corn Breeding;" "Nitrogen Bacteria and Legumes;" "Laboratory Manual for Instruction in Soil Fertility," and numerous others.

Although Professor Hopkins is one of the most eminent agricultural chemists in the United States today, he is probably more widely known as an agronomist. He made his earlier chemical studies the basis for his later work in the improvement of corn. He is the originator of the system of corn breeding which is now being practiced on a commercial scale by seed-corn growers throughout the leading corn-producing states. The results attained by these seed-corn breeders has become one of the most potent factors in stimulating the deep and general interest that is now taken in the improvement of plants. The recognized practical and scientific value of Professor Hopkin's system has made him one of the leaders in that new and most fascinating science,—plant breeding.

'88, B. S. A.—Leonard Pearson, D. V. M. (University of Pennsylvania) 1891, was a student in the Royal Veterinary Academy and in the University of Berlin in 1891-92. Since that time he has been continuously connected with the Veterinary Department of the University of Pennsylvania, now being Dean of that department. He is also state veterinarian, secretary of the live stock sanitary board, president of the State Guernsey Breeders' Association, is a member of the Phipps Institute for the study, treatment and prevention of tuberculosis, and is a member of several other city, state and national organizations. Dr. Pearson is the author of various papers on topics pertaining to veterinary medicine and animal husbandry. He was recently in Europe, where he attended and also contributed to the work of the International Tuberculosis Congress in Paris.

'92, Graduate—Irwin D. Aldrich, a former president of the Agricultural Association, writes from Big Stone, So. Dakota. At present he is publishing a weekly newspaper and holding the positions of president of a corn-canning company, and secretary of the State Board of Regents of Education. He is, moreover, keeping up his interest in Agriculture by looking after a five hundred and sixty acre farm. After his graduate work here, Mr. Aldrich went to South Dakota where he has remained, being at first assistant secretary of the state senate for a session, and later County Superintendent of Schools of Grant County for four years. He is married, and now has three children.

'01, M. S. A.—M. F. Miller, B. S. A., Ohio State Univ. '00, after receiving his degree spent nine months in the Bureau of Soils of the U. S. Department of Agriculture. In 1902 he was appointed instructor, and later became assistant professor of agronomy at the Ohio State University. During this time he was also connected with the agricultural extension work, and for two years was editor of *The Agricultural Student.*

In 1904 Mr. Miller was elected professor of agronomy at the University of Missouri; he also has charge of soils and farm crops in investigations at the experiment station. He is conducting special investigations in the breeding of cereals, mainly of corn and wheat. A state soil survey is being inaugurated, the department of agronomy having charge of the investigations regarding the fertility of the various soil types.

Co-operative experiments, farmers' institutes, "corn specials" and corn shows are other features of the activities of the department. Prof. Miller writes: "Missouri farmers have been noted for their conservatism, but the manner in which they are falling in with the ideas of improved agriculture assures a wonderful agricultural development of the state." The last legislature was very liberal in its appropriations, and the prospects for effective work are very promising.

'01, Special—A. LaVerne Roe who was until a short time ago at the Walker Gordon Farms at Plainsboro, N. J., is now with the Bryn Clovis Dairy Company of Malvern, Pa., and is an interested subscriber to *The Countryman.*

'02, B. S. A.; '05, M. S. A.—George Wheeler Hosford has come back to Cornell as a member of the faculty. Mr. Hosford is supervisor of the Farmers' Reading Courses. Until this spring he was at Hampton, Va., as an assistant in the Agricultural Department of Hampton Institute. During the summer he was with the Orchard Survey of Niagara county and later with Mr. J. H. Hale in his large peach orchards at South Glastonbury, Conn.

'05, B. S. A.—H. R. Cox spent a few days during the early part of November at the University. During the past summer he has been traveling for the James Vick's Sons' Co. of Rochester. After Christmas he will visit the South for the purpose of studying agricultural and horticultural methods.

'05, B. S. A.—W. R. Dunlop became much interested in Guernsey cattle while at college and has carried his interest home with him. He is now building up a Guernsey herd on the home place.

'05, M. S. A.—Arthur Witler Gilbert, B. S., (Mass. Agr. College) '04, is now assistant in the department of agronomy, and is also teaching farm mechanics at the University of Maine. His duties in the future, however, will be chiefly in connection with the Extension work, which he is now developing. As a part of this work, he intends to organize farmers' reading courses and boys' clubs throughout the state.

'05, B. S. A.—Mr. Howard Loop has charge of a small force of men who are sent out by the Pennsylvania State Department of Agriculture, for the purpose of demonstrating methods of destroying San Jose scale by means of spraying. It is not the object of the department to check the scale directly through this work. The work of the party is educational in nature. They will visit the infected areas in different parts of the state, where a demonstration will have been arranged for at some orchard and the meeting thoroughly advertised in order that the farmers of that locality may come to watch the experiment. After applying various mixtures known to be useful in destroying the scale, Mr. Loop will give a short talk on insect pests and the method of combating them. It is hoped that with this instruction farmers will be able to keep the scale in check on their farms.

'05, B. S. A.—Ray C. Simpson is about to start South where he will engage in raising pecans on a large scale. He will conduct the pecan industry as a branch of his father's business, which is at Vincennes, Ind.

'05, B. S. A.—Hayes C. Taylor is back at the homestead near Leonard, Chester, County, Pa. College has not spoiled Taylor for the old farm; he rather likes it all the better after being away for four years. He has entered into local affairs with the zest which characterizes the man with the right college spirit. Between times Taylor gets away from the farm long enough to help in politics as a member of the reform party in Chester county.

'05, Ph. D.—G. F. Warren, the first editor of *The Countryman,* sends his best wishes for the future success of the paper. He is now horticulturist at the New Jersey Experiment Station, New Brunswick, N. J.

BOOK REVIEW

SOILS AND FERTILIZERS. By Harry Snyder. The Chemical Publishing Co., Easton, Pa. 8vo. 295 pages. $1.50.

This is practically a second edition of the work published under the title of "The Chemistry of Soils and Fertilizers" in 1899. The subject matter has now been rewritten, new material added, and laboratory practice made a more prominent feature. The book is largely elementary in nature as it is intended as a text-book for use in agricultural colleges. Of the chapters dealing directly with the soil, that on the chemical composition of soils is especially strong. Perhaps the most valuable of the chapters on fertilizers are those on farm manures and the general use of commercial fertilizers in which the subject is treated in a clear, practical way. Although a large part of the material used in these chapters is by no means new it is presented so as to be readily available for reference or study. There is added a series of thirty illustrated experiments and a list of almost a hundred collateral references. The author, Harry Snyder, (B. S., Cornell '89) was instructor in Agricultural Chemistry at Cornell for several years. He is now Professor of Agricultural Chemistry at the University of Minnesota and Chemist of the Minnesota Experiment Station.

THE CHRYSANTHEMUM. By Arthur Herrington. The Orange, Judd Co., New York. Illustrated. 5 x 7 in., 168 pages. 50 cents.

This little book is a very complete and comprehensive work on the Chrysanthemum. Its scope and character may be gleaned from the list of contents, which comprises chapters on culture for exhibition; composts; planting; benches, boxes or pots; general cultural details; crown and terminal buds; feeding, its object and application; care of the buds; exhibition and judging; specimen plants, chrysanthemum plants in six-inch pots; commercial culture; raising from seed and hybridizing; sports, hardy chrysanthemums; chrysanthemums for south and west; chrysanthemums in Australia; insect pests and diseases; classification and selection of varieties for special purposes; and history of the chrysanthemum. The book will be welcomed both by professional and amateur growers of chrysanthemums, for the lucid, comprehensive as well as the practical character of its contents, which, if strictly followed cannot fail to bring about the desired results, namely, the obtaining of large chrysanthemum flowers in the greenhouse, and a profusion of bloom in the garden.

THE FIRST BOOK OF FARMING by Charles L. Goodrich. Doubleday, Page Co., New York. 5 x 7½ in., 259 pages. Illustrated.

This book grows out of an attempt on the part of the author to present the fundamental principles of agriculture in the order of their importance to farmers, students and teachers. He considers the principles to be those which state the conditions necessary to the growth and development of plant roots and states them as follows:

The roots of farm plants need for their best development, a firm mellow soil, a moist soil, a ventilated soil, a warm soil, a soil well supplied with plant food.

The book is divided into two parts. The first, composing about two-thirds of the volume deals with the general principles underlying plant culture. Under this heading the author discusses roots and their places in the economy of the plant; soils and their relation to plants. The relation of water to soil forms the basis of three interesting and instructive chapters. He concludes the part upon soils with a chapter each upon soil temperature and plant food in the soil.

The nature of seeds and the operations designed for preparing the soil for the reception of seeds are presented

[Concluded on page 80]

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[Continued from page 65]

learn how to control pests, how best to fertilize, and study the needs and problems of the crop. This has not been done in this country but has in England (and Germany, I think), by the Southeastern Agricultural College at Wye and reported annually.

It is an expensive crop to the farmer. If poles are used for supporting the vines, 750 hills per acre, 2 per hill, costing ten to twelve cents each, makes a large outlay. If one pole per hill is used the cost is still large, and strings must be put up in place of the pole saved, to give needed light and exposure for the vines. In either case the decay and wear is large. The summer labor for cultivation is another expense, but the cost of the harvest is the most important item of all —about two-thirds of the whole when ready for market, the remaining third to be divided between annual labor, expense, and use of land, interest on poles, kiln, etc.

As with most agricultural products, there are pests and enemies. First, because earliest, is the hop grub constituted with a special liking for the young vines. The first eggs are deposited in the head of the young vine, thence they drop to the ground and feed on the vines just below the surface. The grub is similar to the common brown corn grub, but more active and has a row of brown spots along the back. Sometimes 10 to 20 may be found in a single hill. When about half-grown the skunk seems to consider them a delicious morsel and digs them out carefully and industriously. No other way has been found except to go from hill to hill and where the vine is wilted or yellow, look for the worm and kill him. Next there is sometimes an attack of a small green fly, which saps the vitality of the plant, which loses its grip on the poles and slides down, like a lazy man not willing to do anything.

[Continued on page 78]

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[Continued from page 76]

There is a curled leaf blight, caused most likely by some unknown insect. Next is the red rust blight, which is worst on the cluster hops—the Red vine and Humphreys being hardier and much less liable. This is a fungus disease, similar to the fungus blight on potatoes. It is first found on the leaves and then eats away the hop itself. Lastly, and perhaps the worst of all is the hop aphis or louse.

These increase very fast in hot humid weather and then if the weather changes, may all disappear in a short time. If they come early the crop may be ruined, as in 1886. Usually they come later and cause the hops to be mouldy and decay. The leaves and even the ground becomes blackened with honey dew. The remedy is to spray with a solution of quassia chips and whale oil soap, but it is disagreeable work and expensive. In England and Oregon growers expect to spray every year, but little has been done in this state.

The conditions of louse thrift are quite narrow. On the one hand, they increase fast, or on the other soon disappear, depending on the weather and who knows what that may be next week. On the whole there seems no crop with as many elements of uncertainty as this. It is a speculative crop, for after all the contingencies of growth and harvest the market may prove unfavorable and the profits or losses may be large.

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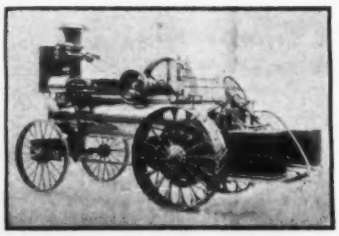

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[Continued from page 74]

in a simple way. The first part of the book closes with a discussion of the other parts of the plant, namely, leaves, stems and flowers in the order of their importance to the farmer. Recognizing that the conditions necessary for root growth are the important factors in soil fertility, the author devotes the second part of the book to a discussion of certain farm operations and practices and their effect upon soil fertility.

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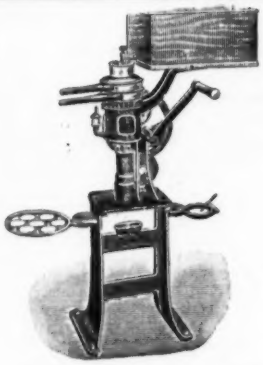
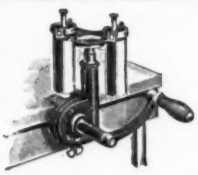
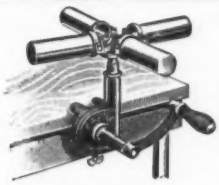

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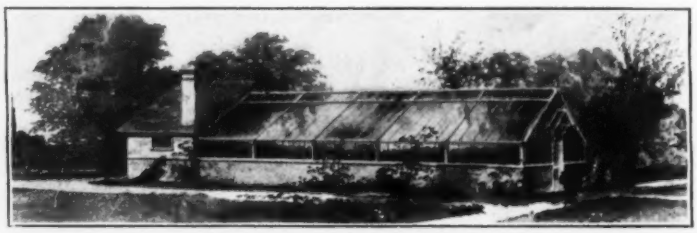

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EASY OR HARD WHICH FOR YOU

Put *Facts* and *Common Sense* to work on a Tubular Cream Separator and **you know it must be easy to operate.** Put *Facts* and *Common Sense* up against a back breaking, hard to wash, high can "bucket bowl" machine and **you can't make yourself believe** it is easy to operate. In the light of truth, the out-of-date, "bucket bowl" separators go to smash. Which kind for you, the

Tubular	*or*	**"Bucket Bowl"**
Low Can	*or*	*High Can*
Simple Bowl	*or*	*Bowl Full of Parts*
Enclosed Gears	*or*	*Exposed Gears*
Self Oiling	*or*	*Oil Yourself*

Catalog O-D tells all about Tubulars. Write for it.

The Sharples Separator Co.

Toronto, Can. WEST CHESTER, PA. Chicago.